

# RESEARCH GROUP REPORTS ON MACHINE HARVESTING OF MICHIGAN GROWN SWEET CHERRIES

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Michigan ranks third among the nation's sweet cherry producing states. In years of high production Michigan grows almost 50 million pounds of "sweets." Plantings have been heavy, and tree counts indicate that the state may soon be producing from 60 to 70 million pounds of this popular fruit. Adequate numbers of hand pickers are no longer available, and a considerable part of the Michigan crop will have to be machine picked if it is to be produced and sold at a profit.

The USDA and MSU research group, of which the authors are a part, has been investigating the possibility of machine harvesting sweet cherries for almost 10 years. However, it was not until 1966 that a major breakthrough occurred. In that year three of the 19 Michigan growers who machine picked sweet cherries permitted the writers to study their harvesting operations in detail. These studies proved conclusively that sweet cherries could be successfully machine harvested on a commercial basis.

This fact was widely publicized, with the result that during the 1967 harvest season almost 100 sweet cherry growers used machines in harvesting more than 2 million pounds of this fruit. Studies of four of these harvesting operations, and observations of several more, brought to light facts which should prove useful to growers who plan to machine harvest sweets during the coming season.

## **Equipment Performance**

Two types of fruit collecting

equipment were included in the studies: 1) frames with self-clearing sloping surfaces down which the cherries rolled onto conveyors, that transferred them to containers in which they were moved to the processing plants, and 2) horizontal roll-out "curtains" which, as they were retracted, transferred the cherries to conveyors that moved them into bulk boxes.

The 1967 studies showed that the horizontal collecting curtains caused significantly more bruising than did the units with sloping surfaces (see Table 1). The increased amount of bruising was due to the fact that when roll-out curtains were used the cherries fell further, and they fell either onto other cherries or onto a flat, rather than a sloping surface. It is also true that some bruising occurred when "pocketed" cherries tumbled over each other as the curtains were being closed.

The 1967 crop was relatively short--sweet cherries were in demand--and none of the fruit included in the trials was downgraded by processors because of bruising. It should be remembered, however, that buyers tend to become more demanding in full crop years, and the time is likely to come when bruised cherries will mean diminished returns.

It was observed that the results obtained depended, to a considerable extent, on the skill of the operators and the nature of the orchards in which the equipment was used. Growers who plan to purchase harvesting machines should see the various

types in actual operation, discuss the matter with the intended processor, and then decide which unit will perform most satisfactorily under the conditions which exist in their particular orchards.

A considerable percentage of Michigan's sweet cherry crop is produced by growers who own tart cherry orchards, and have provided themselves with tart cherry harvesting equipment. The results of the 1967 studies show that these machines can be used to advantage in harvesting all but the oldest and largest sweet cherry trees.

Sweet cherry trees that are 15 or more years old are usually larger than mature tart cherry trees. The scaffold branches of older sweet cherry trees are often 6 inches or more in diameter and difficult to shake. To machine harvest the older and larger trees effectively will require shakers of greater power than those being commonly used in picking tarts. It is estimated that from 25 to thirty percent of Michigan's sweet cherry trees fall into this category, and specialized equipment will no doubt be developed for trees of this size. However, for the present at least, the cherry harvesting equipment which is now, or soon will be, in the hands of growers, will be used in harvesting sweets as well as tarts.

All of the machines used in harvesting the sweet cherries included in the studies here reported were designed primarily for harvesting tart cherries. By the time the 1968 crop matures more than 500 Michigan growers

will have provided themselves with mechanical harvesting equipment. The capacity of these machines will be sufficient to harvest the major part of the sweet cherry crop. Inasmuch as sweets mature before tarts are ready to harvest, the equipment can be used for both crops. Many of the growers who do not own the necessary equipment can probably arrange to have their cherries harvested on a custom basis.

Using the machines for both crops will spread overhead costs, and also enable growers to offer their machine operator employment during a longer harvest season. The situation can be summed up by saying that cherry equipment which will effectively harvest sweets as well as tarts is readily available. It will no doubt be used extensively during the coming season.

When machines of the type described above are used in harvesting tarts, the cherries are normally moved by the conveying system into water filled tanks. When the machines are operating properly, little or no damage occurs during the tank filling operation.

Sweet cherries are not normally handled in water, and when they drop from an elevator into the bottom of a bulk box or onto other cherries in a partially filled container, bruising is sure to result.

The sweet cherry industry needs an inexpensive box filler which will eliminate the damage which now takes place at this transfer point. Inasmuch as a filler is not needed during the tart season, it should be possible to remove the filler from the

harvester after the sweet cherries have been picked.

Most of the leaves, twigs, etc., which come down with machine harvested tarts float to the top of the water filled tanks in which the cherries are handled. When it reaches this point, the material is skimmed off and the cherries are left clean and bright.

Inasmuch as sweet cherries are not handled in water, the trash which comes down with this fruit cannot be floated off but must be eliminated in some other way. Some of the growers visited during the course of the study employed a worker whose duty it was to pick out leaves and twigs as the boxes were being filled. Others installed blowers at the point where the cherries dropped from the end of the elevator into bulk boxes. One producer employed a crew which picked out leaves and trash as the harvested cherries were run over an at-the-farm sorting belt.

None of these methods of eliminating trash proved to be entirely satisfactory. Something better is needed, and the equipment manufacturer or grower who solves this problem will perform a much needed service. It has been suggested that it may be possible to handle sweet cherries in a water or dilute brine solution. This might stop cracking, eliminate the bruises which otherwise occur as the boxes are being filled, and provide a means of floating off trash.

#### Varieties and Harvesting

Although some varieties are more firmly attached to the trees than others, Napoleons, Emperor Francis, Schmidt, Hardy Giant,

Black Tartarian, Hedelfingsen, Gold and Windsor have all been successfully machine harvested. Under favorable conditions growers should be able to machine harvest any of the commercially grown varieties common to Michigan.

As might be expected, the results of the study indicate that the rate at which a crop of either sweet or tart cherries can be harvested depends, to a considerable extent, on the size and age of trees, planting distances, the way in which the trees have been pruned, and the terrain on which the orchard grows.

Michigan operators normally harvest tart cherries at the rate of from 25 to 40 or more trees per hour. The tonnage of fruit obtained depends, of course, on the number of pounds produced by the trees involved.

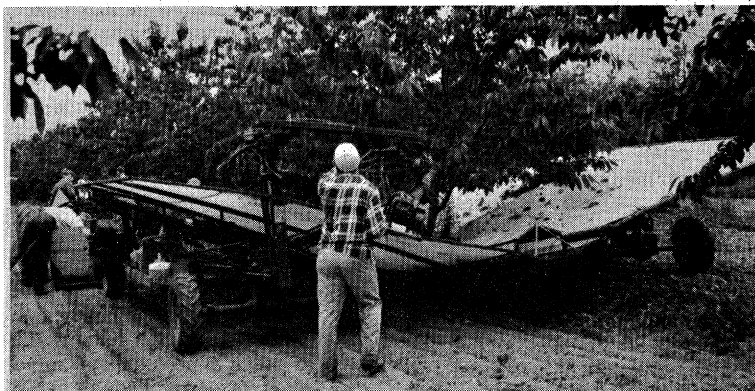
The results of some individual case studies, made during the course of the investigation, should enable growers who have had experience in machine picking tart cherries, or who are familiar with the rate at which this fruit can be harvested, to estimate the rate at which sweet cherries can be machine picked.

Two growers included in the study harvested both sweet and tart cherries with the same equipment. The results obtained by these men, along with observations made in other orchards, indicate that sweet cherry trees of comparable size growing under similar conditions, can be machine harvested almost as fast as tart cherries

(see Table 1).

**TABLE I** Comparison of results achieved in 1967 in machine harvesting sweet and tart cherries with different types of equipment.

Operator	Equipment	Number in crew	Kind of cherries	Variety	Age of trees (years)	Trees per hour	Pounds per tree	Pounds per hour	Percent cherries removed	Percent cherries bruised
A	Sloping surface	4	sweet	Schmidt	11	30	79	2370	94	18
A	Sloping surface	4	tart	Montmor- ency	16	36	83	2988	97	21
B	Flat roll-out	5	sweet	Schmidt	15	26	106	2756	95	28
B	Flat roll-out	5	tart	Montmor- ency	18	32	86	2752	96	34



**This photograph shows the fruit collecting unit with self-clearing sloping sides. Units of this type are used in harvesting both sweet and tart cherries.**

### **Maturity and Recovery**

Maturity is a dominating influence affecting most of the factors which determine the success or failure of a sweet cherry harvesting operation. The results of a study made by the writers showed that as sweet cherries become more mature the percent separated by shaking increased from 60% to 94% during the 16 day period just preceding full maturity. Napoleons, Windsors and Schmidts were included in these studies. The figures represent averages for these three varieties, and it was found that others have similar characteristics.

Mature cherries are not only easier to machine pick, but they have the added advantage of being considerably larger and heavier than cherries that are harvested before they reach this stage of development. Cannerymen prefer cherries that are fully mature.

Unfortunately, allowing the fruit to become fully mature has some very real disadvantages. As full maturity approaches, the number of cracked, scarred and brown rot infected cherries tends to increase. It is also true that dark varieties develop a deep red color which, from the point of view of Maraschino packers, is undesirable. It is hoped that brine-packers will find a way to process dark red cherries. Should they be unable or unwilling to do so, it may become necessary for growers to find other markets for their dark red cherries. Doing so might prove difficult, but growers who can no longer recruit hand pickers must either

mechanize their harvest operation or go out of business.

Growers who allow their sweet cherries to become fully mature take a calculated risk. Most of those who have done so have been successful. On the other hand, most of the growers who have tried to machine pick immature sweets have been disappointed.

It is one thing to decide that maturity is desirable and another thing to determine with assurance when that point has been reached. One index of maturity is the amount of force required to pull individual cherries from the tree. As the fruit becomes more mature, the attachment force diminishes until a point is reached at which most of the cherries can be successfully separated by shaking.

In studying this characteristic, the writers used a small hand-made scale which measured in grams the amount of force re-

quired to separate individual cherries from the tree. It was found that, on the average, during the two weeks preceding full maturity, the attachment force of typical cherries of the Schmidt variety gradually decreased from about 450 to a little over 300 grams.

Unfortunately, a simple inexpensive unit, by means of which this force can be measured exactly is not, as far as the authors know, available. It is hoped that some enterprising equipment manufacturer will place such a device on the market. In the meantime, a little practice should enable growers to determine by 'feel' about when harvest should start. The determination can be made by pulling 12 or 15 cherries chosen at random from various points around the outside of a typical tree. As long as the cherries pull 'hard', they are not ready. When they begin to pull 'moderately hard,' harvest time is approaching. When they begin to come off 'rather easily,' the time to start harvest has probably come.

Size, and the color of both skin and flesh are also indications of maturity. By using all, or a combination of several of these indicators, the grower should be able to decide when to start harvest.

One sure way to choose the right time is to test-snake one or two typical trees. If the recovery is satisfactory, the harvest should be continued. If the cherries do not come off easily, the fruit should be given a little more time in which to mature. The chemical looseners which might help solve separation problems are as yet unavailable.



**This "roll-out curtain" type of collecting unit also has been used in harvesting sweet and tart cherries.**

### Quality

The shaking, incident to machine harvesting sweets, sometimes causes on-the-tree bruising before the fruit separates. This type of bruising is almost sure to be serious, when the cherries are immature and so firmly attached to the tree that prolonged shaking causes the cherries to beat against each other before separating from the tree. Additional bruising occurs when the cherries strike branches on the way down. Still more damage is often caused by the collecting and handling equipment. Still further bruising takes place when the fruit is piled too deep in bulk boxes.

The total amount of bruising ranges from less than 10 to more than 50 per cent depending on the size of the tree, the maturity of the cherries and the type of equipment used. See Table 1 for some average figures.

Bruising lowers quality, and in the final analysis means diminished returns to both growers and processors. On the tree bruising can be kept at a minimum by delaying harvest until the cherries separate easily, after separation bruising can be reduced by providing effective equipment, employing good help and using approved methods.

As already mentioned, delaying the harvest may increase the percentage of cherries with cracks and other blemishes. Some of them can be eliminated at the orchard level by hand sorting. When this is not feasible, the

sorting can be done at the processing plant by either hand sorters or machines. The electric sorters now in common use are already quite effective, and they are being constantly improved.

As reported early in 1967, and confirmed by further studies conducted later that year, brining cherries immediately (within 30 minutes) after harvest: 1) facilitates bleaching, 2) tends to minimize the visual effects of bruising, 3) tends to prevent the loosening of attached stems, 4) causes only a slight loss in weight (1 or 2 per cent), and 5) does not have a significant effect on either size or firmness.

The cherries that were brined immediately after harvest were significantly superior to comparable lots brined after intervals of 4 to 8 hours. In other words, the bruising incident to mechanized picking does not lower the grade nearly as much as it does when the cherries are brined after an interval of several hours. The differences in favor of immediately brining are significant, and growers should work with packers in devising handling methods that will make it possible to brine the fruit immediately after harvest. A separate report on the brining studies is being prepared and will be made available at an early date.

### Handling

Generally speaking, mechanization usually leads to bulk handling -- this is true of sweet cherries. Most machine picked

sweets are handled in bulk boxes of the conventional type. In most of the orchards that were checked, the 24-inch boxes were filled to within 4 to 8 inches of the top, which meant that the cherries were piled to depths of 16 to 20 inches.

Although no detailed studies were conducted, observations, made at the time some of the bulk handled cherries arrived at processing plants, led to the conclusion that piling mature cherries to these depths caused some bruising. The seriousness of the damage no doubt depends on the variety and the maturity of the fruit. Although data on which specific recommendations can be based are not available, growers who use bulk boxes should avoid piling the fruit too deep.

### Summary and Conclusions

More than 2,000,000 pounds of Michigan grown sweet cherries were successfully machine harvested during the 1967 season.

The machines that were developed primarily for harvesting tart cherries can be used in harvesting sweets, and much of the equipment which is now in the hands of the growers will be used for both crops in 1968.

These machines could be improved by adding a box filler and a trash eliminator.

Sweet cherry trees of comparable size can be mechanically harvested almost as fast as tarts. Large and older trees may require special equipment.

Under favorable conditions, growers should be able to machine harvest any of the commercially grown varieties common to Michigan.

Sweet cherries that are to be machine picked should be allowed to become fully mature.

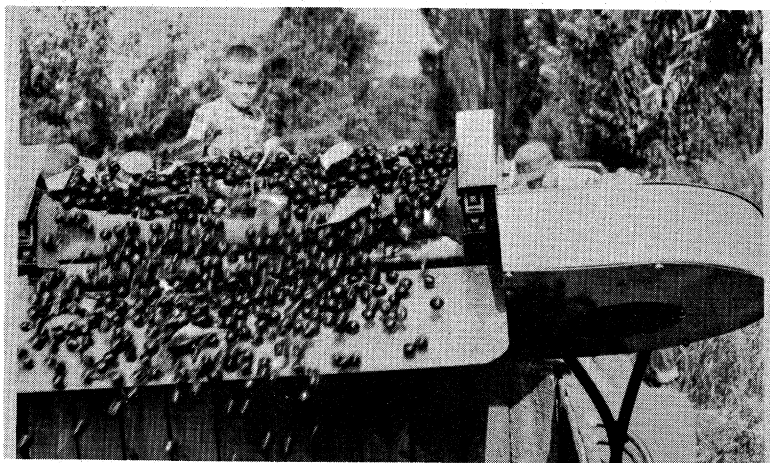
Quality can be maintained by using effective equipment, employing good help and using recommended handling techniques.

Immediate brining helps to maintain the quality of cherries that are made into Maraschinos.

Bulk handled sweet cherries should not be piled too deep.

The possibility of water or dilute brine handling sweet cherries should be investigated.

It seems likely that, in the years to come, a considerable percentage of Michigan's sweet cherry crop will be machine harvested.



Shown in operation is a side-mounted blower, installed at the point where cherries are transferred into boxes. The air blast took out some but not all of the leaves and trash which came down with the cherries.